Mr. HINKS's letter of August 16, 1907:—

Permit me to say that I have been much interested in your discussion of the distortion of the gelatine film in *L. O. Bulletin,* No. 118.

Your results for the absolute distortion are very much of the same order as those which I have found on my own plates, and I entirely agree with you that the general distortion is quite small as a rule. Your result that the treatment of the plates by various methods makes practically no difference is very interesting, valuable, and satisfactory.

With your last result, Summary § 6, I cannot however agree. It is true that the reseau was devised to eliminate distortion of the film, but it has proved itself so useful in other ways that it is still advisable to use it, even if it were absolutely certain that no distortion of the film exists. I would submit to you the following argument: If you do not use a reseau you must either use long screws or refer the measures to scales. Now long screws wear out quickly, are tedious to work with, have temperature errors, and so on. On the other hand, if you use divided scales you have to make as many settings as on the reseau, and you do so at great mechanical disadvantage. Therefore from a purely mechanical point of view I consider the reseau is the best.

Moreover it has in its favor one great practical advantage—there is no need to worry about the plate being disturbed during measurement—it does not matter in the least. And if for any reason you suspect an error in the measures, it is the easiest thing possible to put back the plate and measure up that image in a couple of minutes.

Here we have several people using the same measuring machine. We divide up the day roughly among us, but any man is at liberty to remove another man's plate if he finds the machine not actually at work and wants to use it himself. You can't do that unless you have a reseau, and it is the greatest possible convenience to be able to have this rough and ready rule.

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From my letter to Mr. HINKS, September 30, 1907:—

. . . In regard to the distortions we are in perfect accord. As to the reseau there seems to be some difference of opinion due, I believe, to an imperfect understanding of each other's method of measurement. Especially the following sentence I did not understand: "On the other hand, if you use divided scales you have to make as many settings as on the reseau, and you do so at great mechanical disadvantage." . . .

I agree with you that long screws are out of the question. Metal scales also have a drawback. Glass scales, however, have a number of points in their favor, an important one of which is the fact that they have the same coefficient of expansion as the photographic plate. Our Stackpole measuring machine has two glass scales, one for each coördinate, the distance between two successive rulings being 0.001 inch. The errors of the scale divisions have been carefully determined and are

practically negligible. In measuring, the frame, which carries the setting microscope and the two scale microscopes, is moved on slides parallel to the x and y coördinates (the x-slide is on this frame and carries the setting microscope and one of the scale microscopes) until the intersection of two fixed wires in the setting microscope falls over the center of the star image. The scales are then read off directly in the scale microscopes, the interval between the nearest scale division and the fixed wire in the scale microscope being estimated to the nearest tenth. Thus no micrometers are used for making settings on the scale divisions. One of the disadvantages of the Stackpole machine is that it is not tilted, so that a person must stand stooped over it while measuring. In a differently designed machine this could be remedied, the scale microscopes could be more conveniently placed, and it might be an advantage to have the interval between scale divisions 0.01^{mm} instead of 0.001 inch ($0.025^{mm} \pm$).

As I understand it, for some unaccountable reason the reseau does not always reproduce itself exactly on the photographic plate, so that it is not entirely reliable where the greatest accuracy is desired. . . . For somewhat more approximate [less accurate] measures I will grant that the reseau has the advantage of a slightly greater speed, in that you read off the distances to the reseau-lines in the same microscope that is used for setting on the star. When you want greater accuracy of measurement, you will probably have to use micrometers for measuring the distances to the reseau-lines. In our way of using the scales, the scale divisions from which we take our readings are always very close to the optical axis of the microscopes.

If for any reason you should wish to remeasure an image, the reseau certainly would allow it to be done quickly. As a matter of fact, however, the direct and reverse settings give a check to the measures, and this check is always made before removing the plate.

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From Mr. HINKS's second letter, November 20, 1907:—

. . . I shall try to put briefly my explanations of the way I look at the points mentioned in your letter.

1. Some misunderstanding was caused by my ignorance of the Stackpole machine, which I have never seen described. I did not know that you *estimated* on ten scales to 0.0001 inch ($=0.0025^{mm}$). I always supposed that you measurements went to a somewhat higher degree of *apparent* precision, which would almost necessitate your using microscopes to subdivide the scale. On our machine we measure to 0.0005^{mm}; and though we can't swear to the last figure exactly, I think we can, on a good object, be accurate to within a probable error of about 1 unit in the last place. I imagine that the p. e. of one of your estimates is very much the same,—that is, one unit of *your* last place, which is bigger than ours (x 5). Have you investigated your personal scale—i. e. preference for 5 over 4 or 6 for example? that is often a serious